257/150

BRITAIN B

395,374

395,374 COMPLETE SPECIFICATION

1 SHEET

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

Fig. 2

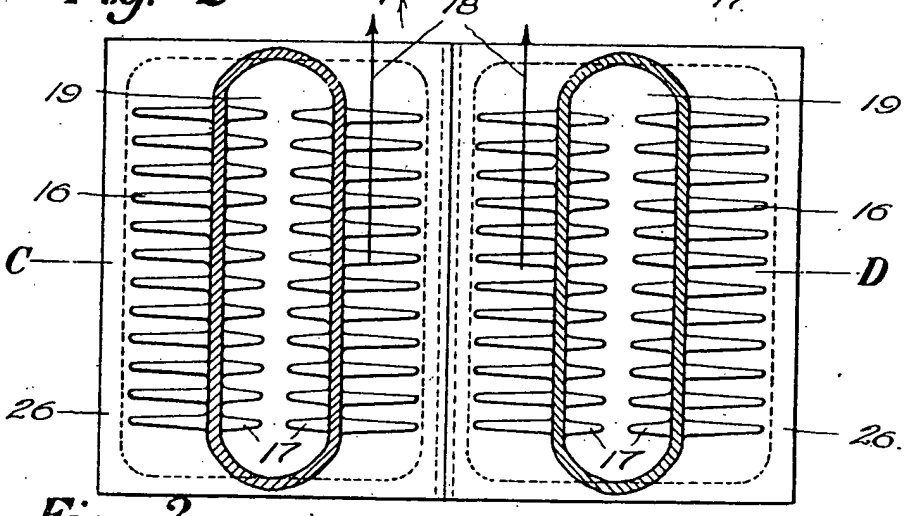


Fig. 3

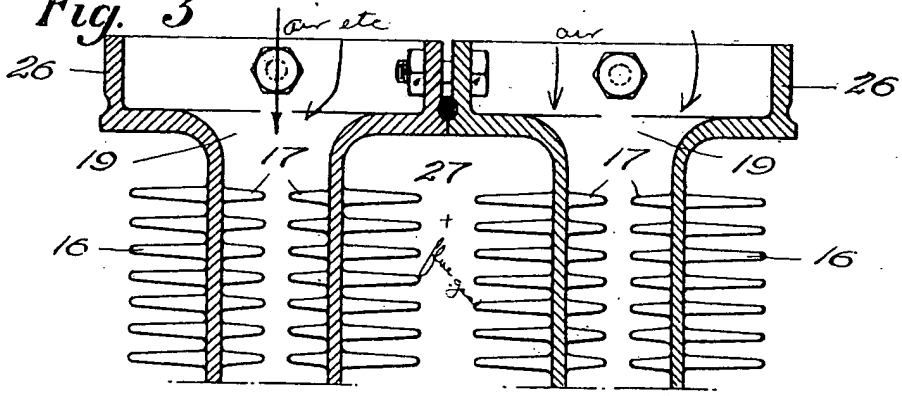


Fig. 4

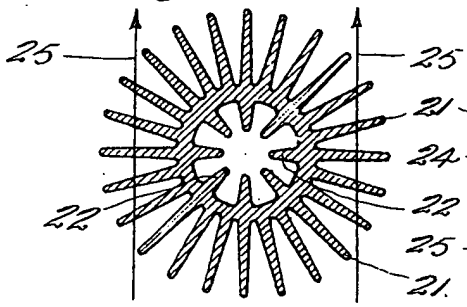
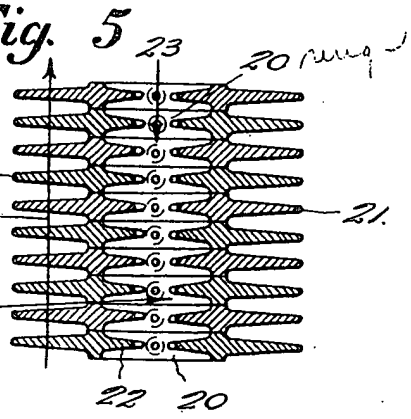


Fig. 5



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PATENT SPECIFICATION

Application Date: Dec. 12, 1931. No. 31,315/31. 395,374

(Patent of Addition to No. 394,324 : dated Nov. 16, 1931.)

Complete Accepted: July 12, 1933.

COMPLETE SPECIFICATION.

Improvements in Tubular Heat Exchange Apparatus more particularly for Heating Air by Flue Gases.

I, PAUL KLEINEWEFERS, German Citizen, of 210, Nordstrasse, Krefeld, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The invention relates to the construction of tubular metal heat exchange apparatus for fluids in particular for heating air by flue gas. It comprises an improvement in or modification of the invention set forth in specification No. 394,324.

In many forms of heat exchange apparatus for fluids it has been proposed to provide tapering projections all over and integral with the wall or walls of the ducts of the apparatus and extending into the path of flow of one or other of the fluids.

According to the present invention a number of spaced tubular metal heat exchange elements with projections on their exteriors are arranged so that passages or spaces are left between them into which the projections extend and through which a fluid flows. The projections, which may be conical or needle-like, are made in accordance with the parent specification and in one with the walls of the elements and are spaced apart by not more than 40 m.m. at their apexes while their thickness at the base on the wall is not more than 20 m.m. Another fluid which is to be heated or cooled by the former is arranged to flow through the tubular elements. It is preferable to provide the interior of the tubular elements with shorter projections. When the elements have been assembled a casing may be arranged round the outside of the elements.

The invention also comprises the provision of the tubular elements with rectangular, flanged, end pieces, by which any number may be secured together with the tubular parts appropriately spaced. The projections can be streamline or drop-like in cross-section in the direction of the stream of the medium.

In the appended drawings two constructional forms of the invention are represented.

Figure 1 shows a perspective view of an element of an air heater constructed in accordance with the invention.

Figure 2 is a transverse section of two elements bolted together.

Figure 3 is a longitudinal section, on line C.D. of Figure 2.

Figure 4 is a transverse section of a further construction of elements of a heater.

Figure 5 is a section at right angles to Figure 4.

The air heater illustrated by Figures 1, 2 and 3 is made up of several metallic tubular elements 15 of which only two are shown. Each element is provided externally with projections 16 and is so shaped that when two elements are bolted together by their flanged ends 26 a passage 27 is formed between them into which the projections 16 extend. One medium e.g. flue gas is caused to flow through the passages 27 in the direction of arrows 18. Each element has an internal passage, or duct 19, provided with smaller projections 17 through which the other medium e.g. air, is caused to flow perpendicular to the surface of the drawing in Figure 2. The elements can be assembled in any desired number, and united to form a large air heating apparatus. A casing may be provided round the outside to direct the flow of the hot gases, and the ends of the tubular elements may be connected so that the path of the air is prolonged. By connecting elements in parallel the capacity of the apparatus is increased and by connecting elements in series the heating effect is raised.

In Figures 4 and 5 where a further constructional form of such an air heater is illustrated, the units consist of superposed ring-like elements 20 provided externally with needle projections 21 and internally with nipples 22 or needle like projections. The one medium, for example, flue gas, in this instance passes through the duct in the direction of the arrow 23, while the air flows over the exterior either in the direction of the arrow 24 or of the arrows 25.

It is important that the projections

should be integral with the walls as shown, or should have a close metallic connection therewith such as would be produced by welding, brazing or like process which is equivalent to the integral construction. A riveted or inserted connection is excluded.

It is preferred to provide layers of bad heat conducting substance such as asbestos between the elements 20 but no claim thereto alone is made herein.

The arrangement and spacing of the projecting pins on the heat transferring wall or surface in the manner herein set forth and claimed is found in actual practice with air heaters and economisers to give an extraordinary increase in heat exchange and renders such apparatus much more efficient than hitherto known.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The improvement in or modification of the invention claimed in specification No. 394,324 consisting in providing the needle like projections upon the outer walls of tubular metal heat exchange apparatus for fluids, in particular for heating air by flue gas, comprising a number of spaced tubular elements over the exteriors of which one of the fluids flows, while the other fluid passes through the tubular elements.

2. Improvement in heat exchange apparatus according to Claim 1 wherein a number of tubular elements with rectangular, flanged, end pieces, by which any number may be secured together with the tubular parts appropriately spaced, are provided externally with needle like projections made as in one with the walls and spaced apart at their apexes by not more than 40 m.m., while their thickness at the base is not more than 20 m.m.

3. Improved construction of tubular, metal heat exchange apparatus for fluids as in Claim 1 or 2 characterised in that the internal surfaces of the walls of the tubular elements are provided with shorter projections.

4. Improved construction of tubular, metal heat exchange apparatus as in Claim 1 characterised in that the tubular elements are each formed by a number of rings which are provided on their peripheral surfaces with the needle like projections.

5. Improved construction of heat exchange apparatus as in Claim 1 or Claim 4 consisting of a number of superposed rings interleaved with rings of heat insulating material such as asbestos.

6. Improved construction of heat exchange apparatus as in any of the preceding claims, in which the cross section of the projections in the direction of the flowing medium is stream line or drop-like in form.

7. Improved heat exchange apparatus for fluids substantially as described with reference to the accompanying drawings.

Dated this 11th day of November, 1931.
BARKER, BRETTELL & DUNCAN.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1933.